PROJ #1054

[redacted] A

December 22, 1964

CONFIDENTIAL

[redacted] 25X1A

Arlington, Virginia 22209

Attention: [redacted] 25X1A

Dear Ed:

Attached please find two (2) copies of our Preliminary Instructions for Use, relating to the Anamorphic Eyepieces. Final instructions are being prepared and will be keyed to a photograph or diagram. These will be forwarded in the near future.

Very truly yours,

[redacted] 25X1A

25X1A

[redacted]

Encs.

Declass Review by NIMA / DoD

Group 1
Excluded from automatic downgrading and declassification

CONFIDENTIAL

S E A S O N ' S G R E E T I N G S

VARIABLE ANAMORPHIC EYEPIECES

INSTRUCTIONS FOR USE

Preparing the Microscope to Accept the Eyepieces

One of the eyepiece tubes on the Bausch & Lomb Microscope is topped with a [redacted] adjustable collar. This must be removed and replaced with the [redacted] fixed collar which is locked in place with a set screw. The adjustable collar is normally found on the left hand eyepiece tube.

To adjust the [redacted] collar to the proper height, focus the microscope on an object while looking through the right eyepiece. (Anormal 10x eyepiece). Then, using the same eye, examine the object through the left eyepiece. If it is out of focus, adjust the tube by rotating the collar until the object is in focus. Lock the collar in place by tightening the set screw with a small driver.

One of the Variable Anamorphic Eyepieces does not have a tube collar. Screw the adjustable tube collar which was removed from your microscope onto this eyepiece.

Explanation of the External Parts of the Variable Anamorphic Eyepiece

Externally the Variable Anamorphic Eyepiece appears to consist of a series of metal rings of various shapes and sizes. These rings serve either to support or control the internal working parts of the instrument. The operation of the individual eyepiece will be described in terms of them beginning at the eyepiece tube collar which is screwed onto the eyepiece tube at the top of the eyepiece.

Located approximately an inch below the eyepiece tube collar are two graduated rings. These indicate the amount of anamorphic magnification being introduced by the eyepiece. The upper one has a single index mark. The lower one is graduated from 1x to 2.7x in steps of .1x magnification. The upper ring is fixed with respect to the eyepiece tube, the lower ring revolves as the magnification of the eyepiece is changed.

Below the graduated magnification index ring is the magnification control ring. This is a wide knurled ring which drives the zoom system and controls the anamorphic magnification of the eyepiece. Rotating it clockwise with respect to the eyepiece tube increases the anamorphic magnification.

Following the magnification control ring is a black ring which is knurled on two sides, and open on two sides to expose the cromeplated ring beneath it. This is the asimuth control ring, and it is used to orient the direction of the anamorphic magnification. There is a single white line on one side of this ring which indicates the power plane of the eyepiece. The orientation of this plane may be read from the 360° graduated circle found below the index mark. This circle is graduated every 2.5 degrees.

Between the azimuth control ring and the graduated circle is the azimuth lock ring. It is the cromeplated ring which is partially covered by the azimuth control ring. Rotating this ring clockwize locks the azimuth control ring with respect to the graduated circle. It should be set just tight enough to prevent the eyepiece from turning as the magnification is being changed.

Beneath the graduated circle is a fixed knurled ring with which one can grasp the eyepiece when loosening or tightening the azimuth lock ring or, the tube clamp ring which is below it. The tube clamp ring is rotated in a counter-clockwize direction to lock the eyepiece to the microscope.

Placing the Eyepieces on the Microscope

Focus the microscope on an object and remove the normal eyepieces. Insert the variable anamorphic eyepieces into the microscope eyepiece tubes. Loosen the lock rings if necessary. Orient the eyepieces so that the 180° graduations are exactly opposite one another. Lock the tube lock rings only tight enough to hold the variable anamorphic eyepieces in place. Place the eyepieces previously removed from the microscope into the eyepiece tubes of the variable anamorphic eyepieces. (The focus of the microscope should not have been disturbed during this process). Look into the microscope and screw the eyepiece tube collars in or out until the object is in focus.

VARIABLE ANAMORPHIC EYEPIECES

FIRST MONTHLY PROGRESS REPORT

SUMMARY

In the first month optical design has been completed. A preliminary mechanical layout has also been completed. This shows the overall length of the unit to be about 5.5 inches from Zoom 70 eyepiece shoulder to the shoulder of the upper eyepiece mount.

Optics have been released for manufacture with a promise date of completion in one month. Delay in completion of optical design slipped the original schedule by three days. Every effort is being made to gain these three days, but the original schedule was so rigid that this may not be possible. Thus a real possibility of a few days slippage in final delivery exists.

The unique nature of this eyepiece has presented some difficulty in analysis by conventional lens design techniques. Scheduling did not permit an exhaustive study of this problem. Thus there is still some question as to the meaning of the results of design analysis. Imagery will be excellent on axis and out to about half full field. Beyond that, it is very good by present interpretation of results, but more study of this problem is required.

Progress This Month

Optical Design

Two design approaches, as proposed, were initiated. One achieved the required anamorphism by use of tilting prisms while the second used a cylindrical zoom lens arrangement. Approximately two weeks of effort showed that it would be impossilbe to reduce the length of the prism system to six inches or less. Hence, this approach was abandoned and all efforts were concentrated on the cylinder system.

Basically the arrangement consists of a modified eyepiece to collimate the light from the image plane of the Zoom 70, the variable power cylindrical lens system, and an objective system to form a real image. In the no power plane, the modified eyepiece and objective lens form a one to one relay system. The final image is then viewed with the conventional Zoom 70 eyepiece. Thus 10X or 20X power is available depending on the upper eyepiece used. The finally achieved zoom ratio is 2.8 to 1.

Originally it had been hoped that the cylindrical variable power system would be of the optically compensated type with single linear motions of the moving lenses. However, in the present arrangement, the image formed in the no power plane is constant independent of the cylindrical lens positions. Optically compensated zoom systems always have some drift of focus which is usually not noticeable. In the present case, a fixed referrant (the image in the no power direction) exists and it was felt the normal optically compensated variations of focus would be noticeable. Hence, the system was changed to mechanically compensated to permit maintenance of exact position of focus throughout the zoom.

The interpretation of analysis results is a problem with this system. The usual method of analysis is to trace rays from a point in the object plane and find their intersection in the image plane. Ideally, they should all meet in a single point. In practice they seldom do and much of the art of lens design resides in interpretation of just how much deviation is acceptable. With cylinder lenses present in the system, the results of analysis differ depending on whether the assumed ideal object point lies in a plane containing the cylinder lens axes or in a plane perpendicular to the axes. To meet delivery commitments, it was necessary to ignore this uncertainty, rapidly develop an interpretation scheme, and do the best job possible within this method of interpretation. As a result, there is some uncertainty as to image quality at the edge of the field. Present interpretation is that some astigmatism will be present in the image of the object lying in the plane containing the cylinder axes, and there will be negligible astigmatism in the image of the alternate object described above. In any event, the axial image will be excellent and imagery should remain very good throughout at least half the field.

An optical schematic of the system as released for manufacture is shown in Fig. 1.

Mechanical

In the third week of optical design, the then existing configuration was released for mechanical design with the full realization that minor changes would be necessary as optical design was completed. A preliminary layout was completed that meets all requirements.

As noted in the original proposal, it is necessary to bend the system through about a two-degree angle to maintain interpupillary distance. This means that it is necessary to rotationally adjust the unit in the stereoscope at the time of insertion and then lock it. Rotation of the anamorphic plane must then be accomplished at a bearing above this lock. Finally, it was deemed desirable to have the zoom control a rotational adjustment of a sleeve fitting around the eyepiece. All of these objectives have been met in the layout.

This layout is now being revised to conform to the final optical design. After completion of this step, necessary detailing will be done, and drawings released for manufacture.

Present length is 5.5 inches from the existing Zoom 70 eyepiece shoulder to the shoulder on which the upper eyepiece will rest.

Because of its preliminary nature, no sketch of the existing layout has been included with this report.

Future Plans

Optical

The manufacture of the optical components will be carefully monitored to assure completion within the required time. Engineering personnel familiar with the job are being made immediately available to manufacturing personnel to answer any questions that may arise.

The question of interpretation of analysis results is being given continued consideration. When this has been resolved, there will exist a clearer understanding of the imagery at the edge of the field.

A very thorough and complete tolerance analysis of the system is being made. The effects of variations of all parameters is being carefully investigated. This is being done to reduce the amount of time required to "tune up" the system at final assembly. Ordinarily, it is cheaper to do this more or less by a "cut and try" method at the final assembly stage. In the present case, however, the delays associated with such a procedure are intolerable, and the more expensive method of machine analysis must be adopted.

Mechanical

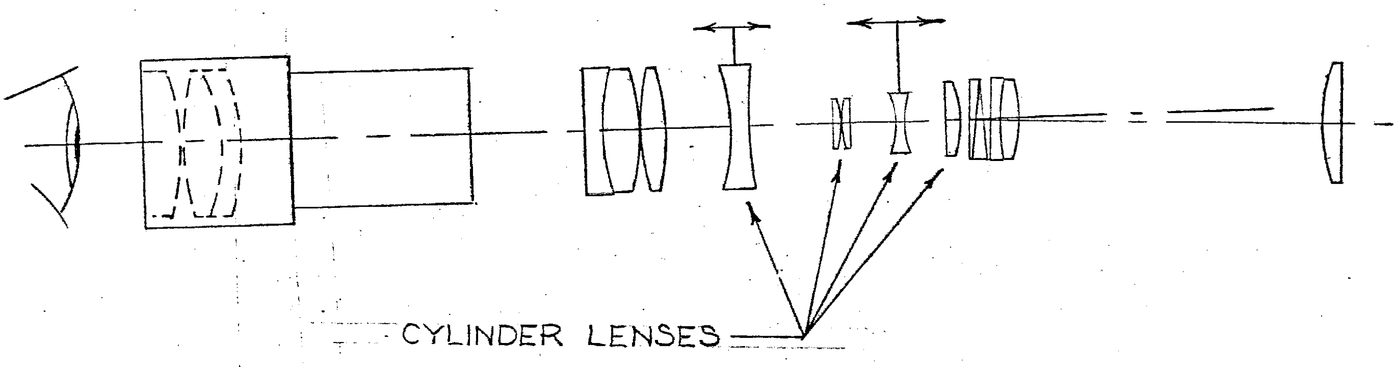
The preliminary layout is currently being updated to conform to final optical design. This operation, plus necessary detailing, should require only a few days. It is expected that mechanical parts will be released for manufacture within a week after the optical parts were released.

Conclusion

There has been approximately a three-day slippage in schedule which may not be recoverable. There is every reason, however, to be optimistic about the successful design of a unit to meet the requirements for a variable anamorphic eyepiece.

FIGURE 1

OPTICAL SCHEMATIC OF VARIABLE ANAMORPHIC EYEPIECE



JMS 6-16-64

STATOTHR

2 June 1964

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I Called [redacted] to determine 0900-0915
status of this development. He said that it was on on schedule there are two unanticipated problems:

(1). The defocussing characteristic of the zoom system which is generally accomodated by the eye is particularly objectionable here because it occurs on only one axis — the other one being fixed, is always in focus. This gives the eye a reference and precludes accommodation for the othe axis. This may be overcome by: manual refocussing, cam refocussing or optical compensation

(2). A similar problem is exhibited by the size and position of the exit pupil which varies differentially on each axis in a similar manner!

[redacted]

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